Structure of a Liquid in Contact with a Solid

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It is expected that the local structure of a liquid in contact with a solid is crucially altered. Modern theories predict a layering perpendicular to the interface within a width given by the correlation lenght of the liquid. Recent x-ray reflectivity measurements at a diamond (111)-Ga (liq.) interface have demonstrated strong evidence for a pronounced layering in the liquid density which decays exponentially with increasing distance from the interface. The modified liquid layer is expected to show an in-plane ordering of medium range induced by the periodic potential of the crystalline solid. This leads to several interface related x-ray scattering signals, which may be subdivided into (i) a contribution of the liquid structure factor to the in-plane Bragg peaks of the solid, (ii) a replication of the liquid scattering around the reciprocal lattice points of the crystal structure, and (iii) an anisotropic in-plane modulation of the (normally isotropic) structure factor of the liquid.

We are describing a new method for the experimental determination of liquid structure factors at solid-liquid interfaces. In order to achieve the necessary interface sensitivity we exploit the effect of total internal reflection such that an evanescent wave is created within the liquid parallel to the interface. By using this exponentially decaying x-ray wave field the liquid structure parallel to the interface be probed. We will discuss recent scattering experiments at the interface Pb(liq.)-Si(001) which revealed distinct modifications in the interfacial liquid structure factor. In these experiments we have for the first time detected the azimuthal anisotropy in the liquid structure factor.